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OPTIMIZATION OF ZONE ROUTING PROTOCOL

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ABSTRACT

Reactive and proactive protocols have several advantages in ad hoc network. Proactive protocols provide less delay and reactive protocols uses less bandwidth, but it in order to use these advantages properly, it is better to use them in a combine manner rather than using them independently. A Hybrid protocol takes advantages of these protocols and overcomes the disadvantages of both. A popular hybrid protocol is Zone Routing Protocol. As the name implies the whole network is divided into zones, within the zone proactive protocol is used and between the zones reactive protocol is used. In this paper the performance of ZRP is shown using different radius and nodes on NS2. TORA is used as within the nodes and DSDV between the zones. Performance is judged by using PDR as a parameter. This is done to know at which radius and number of nodes the performance of ZRP is the best. ZRP is a not a distinct protocol as it provide framework for other protocols.

KEYWORDS: ZRP, TORA, DSDV, PDR, NS2

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Original Article

INTRODUCTION

Mobile Ad hoc networks are unconventional network of autonomous mobile node connected over wireless link. As network employs mobile node, it does not have any fixed topology and central management. All node work as a router whose primary function is to provide best routed path in a given direction of destination. Ad hoc network uses routing protocol for routing, there are many types of routing protocols like; proactive, reactive and hybrid routing protocols. In proactive routing protocols, if a source wants to send packet to destination nodes it does not have to wait for route, because routes are already provided by the network. Routing procedure takes two approach; route request and route reply. On the other hand the disadvantage is that it sends route request packet to all the nodes in which a lot of bandwidth is wasted a very used proactive protocol is “TORA” protocol. In reactive protocols the route is maintain on the request of the source node because of this source node has to wait until the route is provided by the network thus source node suffer delay. On the other hand the advantage is that route request is send only to the node to which packet is to be send so bandwidth is utilized very popular reactive protocol is “ DSDV” protocol. Hybrid protocol is a combination of both of the protocol most commonly used hybrid protocol is “ZRP”.

This paper is divided into 5 parts. In the first part description of ZRP is given with its architecture. A second part tells about the background of ZRP. The third part tells about the proposed work, fourth parts deals with the simulation and result and the fifth part tells about conclusion and future work.

ZONE ROUTING PROTOCOL

As the name implies Zone routing protocols is a hybrid protocol in which complete network is dived into zone of radius ‘þ’ that include nodes that are hop count away from each other. The complete protocol is composed of four

protocols; IERP, IARP, NDP and BRP. Nodes in the zone are kept as; Nodes with hop count = þ are called as peripheral node, nodes with hop count <þ are called as exterior node, nodes with hop count> þ are called as interior node.

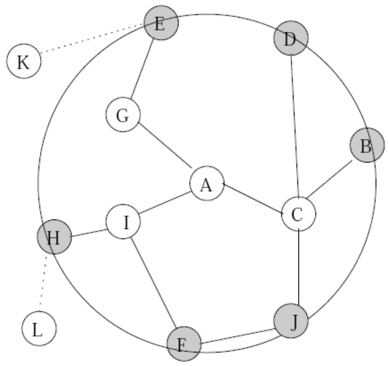

Figure 1: Zone of 'A' with Radius þ = 2

In the above example for node 'A', nodes 'C', 'I', 'G' is one hope count away from 'A' and the radius of zone is 2. This means these nodes will stay inside the zone because hope count< þ. But nodes B,J,D,E,H,F are two hop count away from 'A' so hope count= þ, so all of these nodes will act as peripheral nodes. For nodes 'k', 'L' hope count > þ, so these nodes will stay out of the zone.

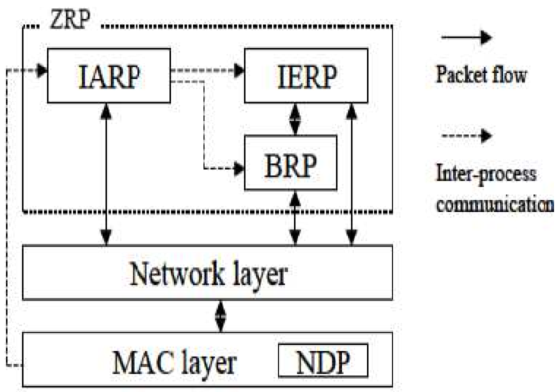

Figure 2: Architecture of ZRP

NDP

Neighbour discovery protocol is used by a node to know about its direct neighbour. This is done by sending 'hello' beacons by source node, node that wants to communicate replies with a response. Once the local routing information is achieved node periodically broadcast discovery message to know up to date information about its neighbour node.

IARP

Intra zone Routing Protocol provides the possibility of direct neighbour discovery. This protocol helps in determining the routes to the interior nodes to the peripheral nodes and is commonly a proactive protocol. The nodes inside the zone are able to communicate with each other with the help of this protocol.

IERP

Inter Zone Routing protocol is used to perform routing outside the zone. This is commonly a reactive protocol.

This is called as Global discovery protocol. In ZRP if the node has to send packet that is outside the zone first interior node will sent to peripheral node than peripheral node will send it to the other zone where destination node resides rather than flooding packets to all nodes. This process of providing route from the peripheral node to the destination node located inside the other zone is done by IERP.

BRP

Border cast resolution protocol is used to direct route request by IERP to peripheral node. It keeps track to which nodes query has to be delivered. For the nodes that do not lie in the zone from which query has been received it constructs a border cast tree to pass it to the neighbour node. The node after receiving query packet again constructs the border cast tree to determine whether it belongs to the tree of sending node.

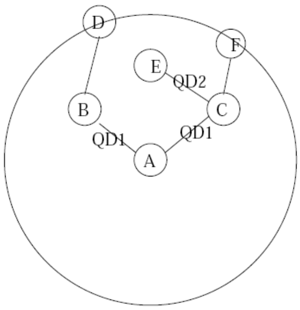

Figure 3: Query Detection

Direct query in known as query detection one (QD1) ,when node receive information by listening to traffic broadcast among other node it is known as query detection second (QD2).

In order to eliminate unnecessary broadcasting BRP uses selective border casting. In this approach peripheral nodes that are not in use are removed.

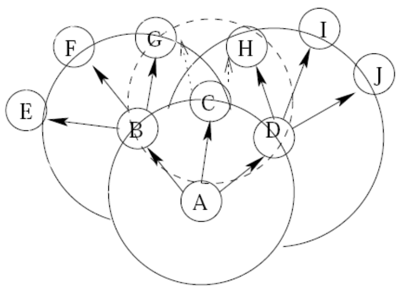

Figure 4: Selective Border Casting

In the image it is clear that node C is an unnecessary node it can be removed by A. So the performance of the network can be increased by using selective broadcasting. Relation between the components is route updates are performed by NDP, which notifies IARP when the neighbour table is updated. IERP uses the routing table of IARP to respond to route queries. IERP forwards queries with BRP. BRP uses the routing table of IARP to guide route queries away from the query source.

BACKGROUND

Sree Ranga Raju, Jitendranath Mungara evaluated the performance of ZRP using Qualnet simulator 4.0. In their

paper, they unified two new algorithms, i.e., to selectively Border cast the control packets in order to reduce the network load by limiting the number of control packets when ZRP searches for a new route. The second algorithm is proposed to optimize the performance of Query control mechanisms for the Zone Routing Protocol (ZRP) for mobile ad hoc networks for communication on an urban terrain. By using these algorithms they defined ZRP as Enhanced ZRP and showed that on using these algorithms the performance of ZRP was better than that of conventiona

Shailendra Kumar Pathak, Raksha Upadhyay, Uma Rathore Bhatt evaluated the performance of ZRP using Qualnet simulator 5.0.2. In their paper an algorithm for controlling the forwarding of query packets has been provided. These query packets are forwarded by the nodes which are the local zone member of that node which has immediately broad casted or forwarded these query packets. Hence by limiting these query packets forwarding inside the local zone of a node minimize the network traffic and load. By using this algorithm there was reduction in control packets so they named ZRP as ZRP1 and compared it with conventional ZRP, the performance of ZRP1 was better than that of ZR

Tiguiane Y´el´emouxz, Philippe Meseure x, Anne-Marie Poussardx, increased the performance of ZRP by taking account the quality of links. In their paper they introduced bit error rate based approach of ZRP (BER-ZRP). With BER-ZRP, all phases of links state recording and routing table's calculation are under Quality of Service control so that better paths in terms of BER are preferred. The overhead induced by route maintenance and route discovery processes is better managed. This approach allows improving ZRP Packet Delivery Ratio and Normalized Oversize Load. They founded routes where packets have better chances to reach their destination without needing several retransmissions. Nodes with bad links (in terms of BER) are excluded from the route request process. To measure the effectiveness of their approach, they used simulation with realistic wave propagation and mobility models. Their approach gave good results than that of conventional ZRP.

Amit Kumar Jaiswal, Pardeep Singh in their paper proposed a routing protocol named Optimizing Velocity Based Adaptive Zone Routing Protocol (OVBAZRP) that is more stable and better routing performance in scenarios where mobile nodes move with non uniform speeds, an Optimizing Velocity Based Adaptive Zone Routing Protocol (OVBAZRP) is proposed which allows different nodes choose different zone radius according to each node's distinct speeds. In OVBAZRP protocol, the intra zone active routing protocol and border cast resolution protocol of ZRP are redesigned. Several examination control mechanisms to reduce the routing lookup overhead are also included. OVBAZRP modifies the ZRP and speed of the nodes in MANET can be determined within a reasonable approximation by utilizing the signal strengths received from the neighbouring nodes. This modified ZRP is again better than that of conventional ZRP.

Sandeep Kaur, Supreet Kaur in their paper performed the analysis of ZRP on the basis of parameter like; throughput, load, data dropped and delay using Qualnet simulator 14.0 on 20 40 and 60 nodes. From the results they concluded that with the increase in number of mobile nodes, ZRP gives high throughput. Load increases with the increase in nodes. With 20 nodes, it gives minimum load but as the nodes increases, a high load is observed. With high load, the delay is also high. Data dropped also increases with the increase in number of nodes.

PROPOSED WORK

The work is to analyse the performance of ZRP on different nodes and radius. Nodes from 0-80 are taken with radius 0-9.Simulation is performed on Network simulator 2.35 and packet delivery ratio is estimated. To determine on how many nodes and at which radius the performance of ZRP is the best. The area is 10000*10000 because for 80 nodes

analysis has to be performed.Inside the zone TORA protocol is used and outside the zone DSDV is used. Source nodes is the first node and destination node is the last node for node from 10-80.

Packet Delivery Ratio (PDR) – It is the ratio of the number of packets successfully received by all destinations to the total number of packets sent to the network by all sources.

$$PDR = \left(\frac{Recivedpacket}{sentpacket}\right) \times (100)\%$$

SIMULATION AND RESULTS

Table 1: Parameters

Channel Type	Wireless
Radio Propagation Model	Two Way Ground
Antenna Type	Omni Antenna
Packet Size	512 bytes
Nodes	10-80
Data rate	11Mb
Mac Type	802_11
X*Y Area	10000*10000

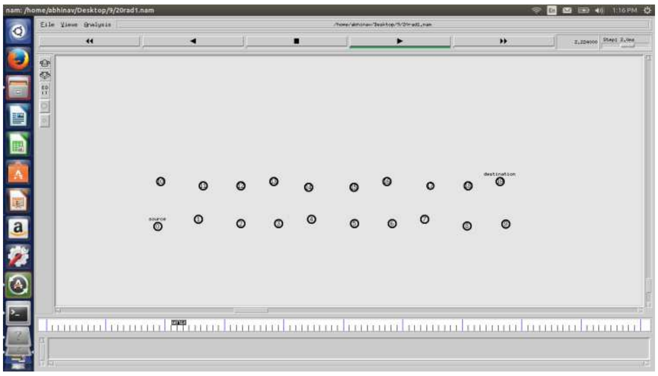

Figure 5: NAM Output

Figure 5 is the NAM file of 20 nodes where source is node 0 and destination is 19. After 3-4 seconds various zones builds up that includes node in them. Nodes themselves become peripheral, interior or exterior according to the zone radius.

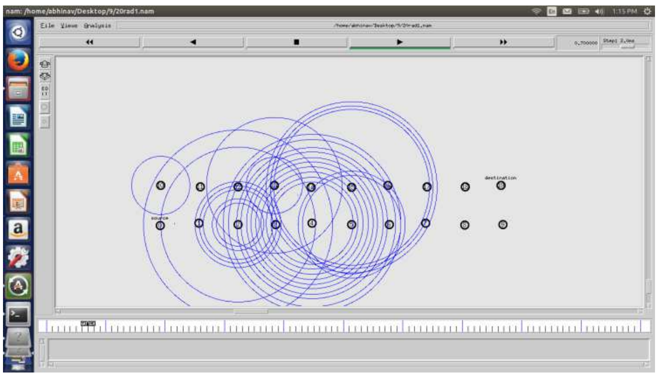

Figure 6: NAM Output

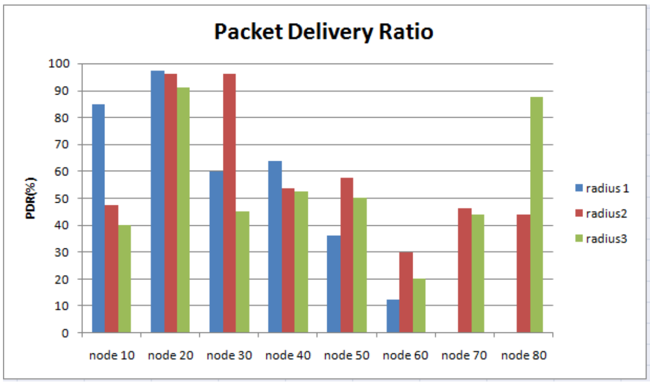

Figure 7: Packet Delivery Ratio (Radius 1, 2, 3)

It is clearly visible here that for 20 nodes PDR is maximum at radius 1, 2, 3. Radius 1 can only be used till 60 nodes because after this, it gives least values of PDR. Up till 80 nodes radius 2 and 3 should be chosen for achieving good PDR. So if we want a zone of 20 nodes any radius from 1 up to 3 can be taken or vice versa.

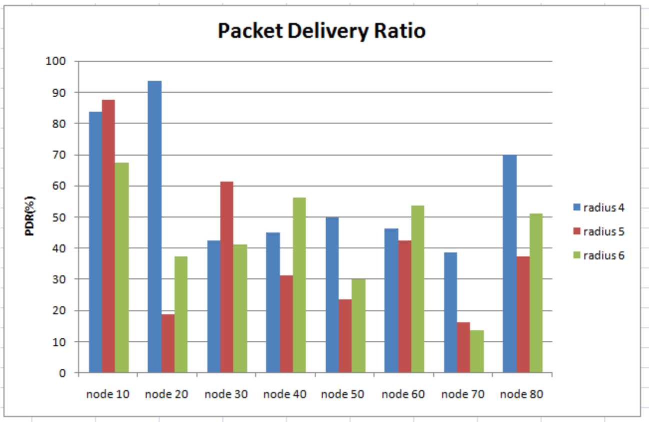

Figure 8: Packet Delivery Ratio (Radius- 4, 5, 6)

For 10 nodes the radius 4, 5, 6 are showing good results of PDR. But for 20 nodes at radius 4 PDR is maximum. PDR is average for 30, 40, 50, 60 nodes. For 70 nodes PDR is least and at radius 4 for 80 nodes PDR is also showing good results. For 80 nodes taking radius 4 will also give optimal values of PDR. Radius 6 is only giving good result for 10 nodes, 40 nodes and 80 nodes.

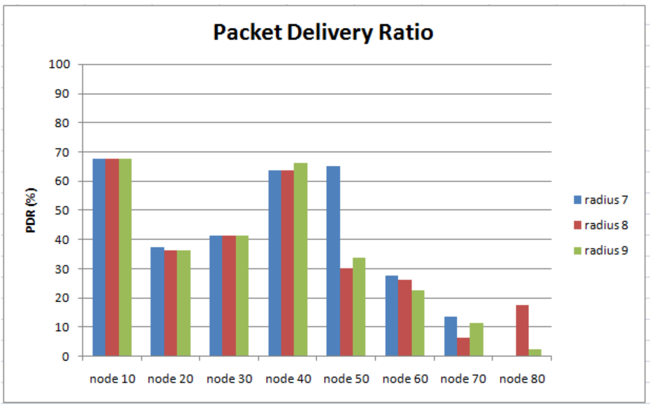

Figure 9: Packet Delivery Ratio (Radius 7, 8, 9)

We can see here 10 nodes at radius 7, 8, 9 are again showing optimal results. There is sudden decrement of PDR for 20 nodes. 60, 70 and 80 nodes show bad result of PDR. For nodes 40 and 50 average PDR is achieved. Here we can see as we are increasing number of nodes and radius we get less PDR. We should never take 7, 8, 9 radius if we want a zone of 80 nodes. Radius 7 is showing fine results for 10, 40, 50 nodes.

So we can conclude now that for 10 nodes radius 1, 4, 5, 6, 7, 8, 9 can be taken for good PDR. This means 10 nodes show good result in ZRP. For 20 nodes radius 1, 2, 3, 4 should be taken this gives excellent PDR. For 30nodes radius 2gives excellent PDR and radius 4 gives average PDR. For 40 nodes radius 1, 6, 7, 8, 9 can be taken for average PDR. For 50 nodes in ZRP radius 7 should be taken for good PDR. For 60 nodes only radius 6 should be taken. For 70 nodes only radius 1 gives normal PDR. For 80 nodes radius 3 & 4 gives good PDR.

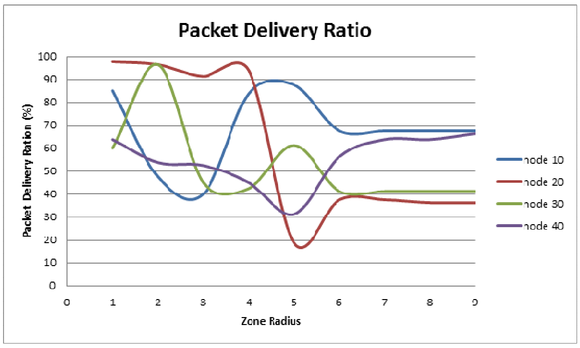

Figure 10: Packet Delivery Ratio Relative Analysis

It can be said now for 20 nodes good values of PDR is achieved but decrease thereafter, while at 10 nodes maintains constant performance increases with increase zone radius(except radius 2 &3)

CONCLUSIONS & FUTURE SCOPE

In this paper the optimization of ZRP has been performed by taking different radius and different nodes. It can be stated that 20 nodes are best for radius 1, 2, 3. Radius 4, 5, 6 gives average values for 30-80 nodes and good values are only achieved at radius 4 for nodes 10, 20 and 80. Nodes from 40-70 shows varying performance as radius is increased or decreased. Still 40 nodes give good PDR at radius 7, 8, 9 and 50 nodes at radius 7 only. So for radius raising 1-3, 20 nodes should be taken and vice-versa. For radius 4-6, 10 nodes should be taken and for radius 4 again 20 nodes are good and 80 nodes. For radius 7-9 only 10 nodes or 40 nodes should be taken. In future the performance can be judged by taking more than 100 nodes in the network with changing position on source and destination at different time.

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